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**LANDSAT 4 BAND 6 DATA EVALUATION**

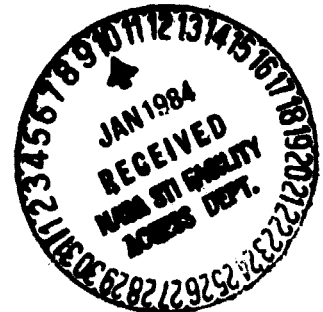
Contract #NAS5-27323

**Fifth Quarterly Report**

December 15, 1983

Prepared for:

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Greenbelt, Maryland 20771



(E84-10054) LANDSAT 4 BAND 6 DATA  
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G3/43 00054

## Objectives:

The objectives of this investigation are to evaluate and monitor the radiometric integrity of the Landsat-D Thematic Mapper (TM) thermal infrared channel (band 6) data to develop improved radiometric preprocessing calibration techniques for removal of atmospheric effects.

## Problems:

Continued lack of simultaneous TM and underflight data is delaying much of the major thrust of the effort. At present we are anticipating that time extensions will be required to complete the program. Until scheduled TM data collection resumes, it is difficult to estimate completion schedules or any costs that might be associated with a time extension.

## Accomplishments:

Efforts this reporting period were directed at comparison of ground surface temperature data and predicted satellite data. The satellite data collected on 9/13/82 over Lake Ontario were processed to observed surface temperature values. This involved computing apparent radiance values for each point where surface temperatures were known from averaged digital count values. These radiance values were then converted by using the LOWTRAN 5A atmospheric propagation model. This model was modified by incorporating a spectral response function for the Landsat band 6 sensors. Also included was a downwelled radiance term derived from LOWTRAN to account for reflected sky radiance. In this manner a blackbody equivalent source radiance can be computed from

$$L_T = \frac{L_o - L_u - \tau r L_D}{\tau \epsilon}$$

where

$L_o$  is the observed spectral radiance at the spacecraft,

$L_u$  is the upwelled radiance computed from LOWTRAN based on the radiosonde data for 7 A.M. on 9/13/82 (corrected for burnoff of the radiation inversion to 9:30 A.M. equivalent),

$L_D$  is the downwelled radiance derived from LOWTRAN,

$\tau$  is the atmospheric transmission derived from LOWTRAN (note that all these terms are corrected for the spectral response function of the TM),

$\epsilon$  and  $r$  are the emissivity and reflectivity of water, respectively (set at 0.986 and 0.014),

$L_T$  is the equivalent blackbody radiance associated with a surface at temperature  $T$  for the bandpass of interest.

The surface data were collected on a routine cruise by the Canada Center for Inland Waters (CCIW). These data were taken over the western end of Lake Ontario on the day of the satellite overpass and the following day. Twenty-nine points were used in the analysis. Figure 1 shows a plot of the measured temperatures against the predicted temperatures. The RMS error between the data sets is 0.51K.

This is an extremely promising result, however, it must be used cautiously. As seen in Figure 1 the satellite data interpreted in this fashion will seriously over estimate low temperature values and under estimate high temperature values. In this case, errors of several degrees would be expected of temperatures of 285K and 295K. At present it is not known whether these errors originate in the spacecraft data, the surface data or the atmospheric propagation data. The surface data are most in doubt at the present time due to their point nature and the need to correlate with a large satellite footprint.

Future satellite underflights are designed to eliminate these doubts. Both the ground truth and atmospheric propagation parameters should be well defined so that residual errors can be properly assigned.

Significant Results:

None this reporting period.

Publications:

None this reporting period.

Recommendations:

None this reporting period.

Funds Expended:

\$53,316 representing 44% of the total program effort.

Data Utility:

N/A

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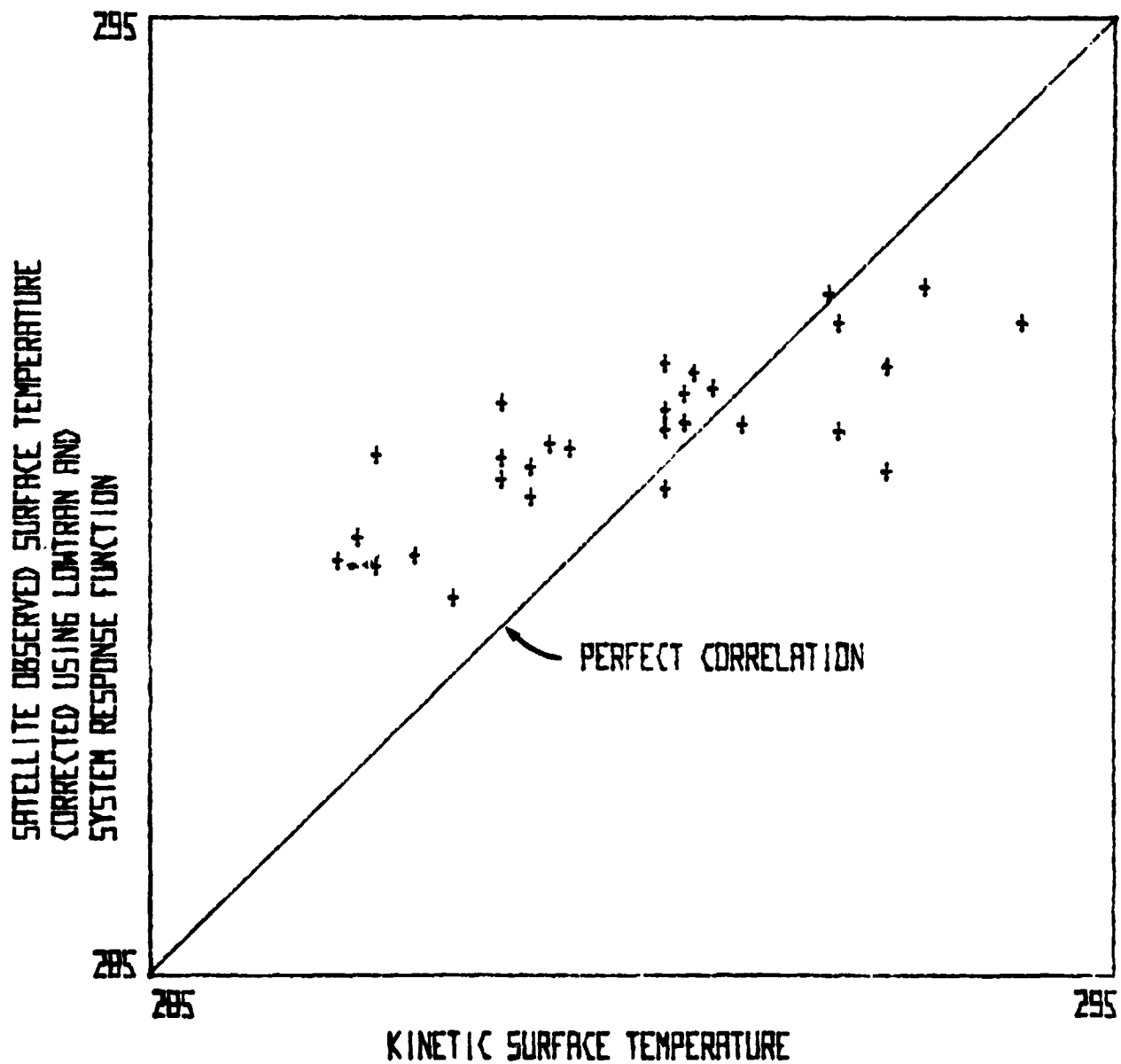


FIGURE 1. PLOT OF MEASURED TEMPERATURE VS. SATELLITE PREDICTED VALUES